

LOWELL OBSERVATORY  
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7 August 1991

Dr. Jürgen H. Rahe  
Solar System Exploration Division  
Code SL  
NASA Headquarters  
Washington, DC 20546

Dear Jürgen:

Enclosed are three copies of our *Final Report for NASA Grant NAGW-1864*. This was a one-year grant, nominally beginning 1 December 1989, titled "Planetary Research at Lowell Observatory." It supported the work that had previously been funded for a number of years by NGR-03-003-001 (for which our Final Report was submitted 31 May 1990).

Work under NAGW-1864 has been carried to conclusion under a no-cost extension.

We would also like the enclosed report to serve as *Status Reports 1 and 2* covering the period of the grant. During this report period, the supported personnel were those shown on the title page of the report. No unusual expenses occurred. A financial report will be sent separately to Code BFH.

Sincerely yours,

*William A. Baum*

William A. Baum  
Principal Investigator

cc: NASA Sci and Tech Info Facility

Mr. G. Max Irving  
Dr. Robert L. Millis  
Dr. Otto G. Franz  
Dr. David G. Schleicher  
Dr. Tobias J. Kreidl

(NASA-CR-193774) PLANETARY  
RESEARCH AT LOWELL OBSERVATORY  
Final Report, 1 Dec. 1989 - 30 Jun.  
1991 (Lowell Observatory) 5 p

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FINAL REPORT  
for  
NASA GRANT NAGW-1864  
"PLANETARY RESEARCH AT LOWELL OBSERVATORY"  
1 DECEMBER 1989 — 30 JUNE 1991

7 AUGUST 1991

*William A. Baum*

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*Tobias J. Kreidl*

TOBIAS J. KREIDL  
Co-Investigator

## HISTORY

This document is the *Final Report* for NAGW-1864, which has supported the comet portion of planetary research at Lowell Observatory for a nominal period of one year beginning 1 December 1989. This document will also serve as *Status Reports 1 and 2* covering the period of the grant.

Grant NAGW-1864 was essentially a one-year continuation of NGR-03-003-001, which had supported a very broad range of planetary research at Lowell Observatory since 1969. That work dealt with phenomena in the atmospheres of Mars and Jupiter, the dimensions and orbits of asteroids, the chemistry of outer planet atmospheres, the properties of planetary rings, the co-discovery of the Uranus ring, and studies of comets. Those accomplishments were summarized in the Final Report of NGR-03-003-001, submitted 31 May 1990.

## STRATEGY

Work since December 1989, i.e., work covered by NAGW-1864, has been almost wholly concerned with comets. Our goal has been to understand the physical properties of comets by applying a wide variety of observational techniques. We have particularly emphasized simultaneous or coordinated observations in different spectral regions, such as visible together with thermal infrared, or visible together with far ultraviolet. And we have used a variety of observational techniques, including imaging, spectroscopy, and photometry. We have

- measured the basic properties of cometary nuclei by studying comets whose comae are so anemic that the signal from the nucleus can be extracted,
- investigated the group characteristics of comets by narrowband photometry applied uniformly to a large sample of comets,
- probed the detailed physics and chemistry occurring in comae through wide-field CCD imaging using narrowband filters and through long-slit CCD spectroscopy, and
- investigated the rotational states of comets through time-resolution photometry.

## ACCOMPLISHMENTS

During the period of this grant, we have conducted three major observing campaigns: (1) Photometric observations of Comet Levy (1990c) began in early July 1990 and continued into 1991. Strong asymmetry about perihelion was observed for all species. Time-resolution monitoring of Levy in late August 1990 revealed periodic variations with a 19-hour period. Levy is the first long-period comet in which rotational variations have been observed using photometric techniques. (2) In May and June 1990, extensive sets of coordinated observations of Comet Austin (1989c1) were acquired using a conventional photometer on the Lowell 42-inch telescope, a long-slit CCD spectrograph on the Perkins 72-inch telescope, and a Texas Instruments 800×800-pixel CCD on a Takahashi  $\epsilon$ -200 f/4 telescope. (3) Observations of Comet P/Encke were obtained in October 1990 in order to understand better the apparent decoupling of OH from other species seen in earlier apparitions of this comet at small heliocentric distances.

Several comet projects involving the analysis and interpretation of earlier data were also carried forward: (4) We have written up a substantial collection of CCD imaging observations for publication. As reported earlier, images taken in the spectral continuum imply that coma grains are often "fading" as they travel outward. (5) We have analyzed photographic photometry of Comet P/Halley from the 1910 apparition, and we have been able to present strong evidence that Halley exhibited the same 7.4-day brightness variations in 1910 that we discovered during the recent apparition. (6) Progress was made in organizing our database of narrowband photoelectric photometry, which now includes data for 80 comets.

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